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ABSTRACT

Over a period of five semesters, the attitudes of preservice secondary mathematics teachers participating in seven varieties of educational experiences were measured using the Mathematics Teaching Inventory (MTI). Items on the MTI were scored for modern versus traditional attitudes. Seven subscales were generated by classifying items on the basis of whether they involved perception of mathematics teaching or teaching in general and whether there was a teacher or non-teacher focus. Data collected for the seven groups on these seven scales were submitted to an analysis of variance. Results indicated that, in general, students with only observation experiences held more modern and open attitudes than students with teaching experience. This result was most significant for the subscale concerning mathematics teaching behavior. On the basis of this study and related research it is recommended that early school-based experiences should be offered to preservice teachers, but that these experiences should be carefully selected to avoid negative effects on attitudes. (SD)

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The Effects of Practicum Experience on the Opinions of Secondary Mathematics Teachers.

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Early involvement of prospective teachers in school-based activities has become accepted as a desirable component of teacher training. It is generally agreed that this involvement is needed since it helps students relate their experiences to theory, provides for evaluation of performance of teaching skills, and helps students make the transition to the role of a teacher. Although there is a great variety in the specific components of implementing early experiences, most plans provide for a gradual introduction, beginning with observation, then tutoring or short lessons with small groups of students, and finally teaching longer units or larger groups of students. These experiences, which take place during the sophomore and junior years, are followed by a six to eight week student teaching experience of full-time teaching. A compilation by Higgins (1972) provides description of eleven such school-based programs for secondary mathematics prospective teachers.

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The objectives of early school-based programs are somewhat general and the provisions for evaluation are often limited, since the activities within a program are varied and not easily controlled for experimental or evaluation purposes. Reports of programs are unanimous in their informal assessments that students are enthusiastic, teachers enjoy being involved in the university program, and pupils gain from their experience in being tutored and other activities with student teachers (Erb 1972, Higgins 1972).

In contrast to the positive effects, some fairly common patterns seem to have emerged which indicate early experiences produce changes in negative directions. Graening (1972) reported a program in which juniors spent mornings as teaching aides in junior and senior high schools. The experience produced a significant decrease in the students' enthusiasm and idealism toward teaching mathematics. Certain types of cooperating teachers produced a greater dampening effect than others in their teacher aides. Kulm (1973) reported that student teachers in traditional programs had significantly higher attitudes toward mathematics teaching than those teaching in innovative programs. In addition, the skill of the supervising teacher significantly affected the students' view of the teaching profession. The presence of a student teacher is not always positive in the view of pupils.

For example, Brottman and Soltz (1971) found that childrens' satisfaction with classroom climate decreased significantly over the student teachers' term.

Finally, it is necessary to consider the costs incurred by supervision staff and travel which many of the programs require. Osburne, et al (1972) estimated that the cost of such a program was 20 percent over their previous program. A second practical consideration is the large blocks of student time off-campus to participate in the program.

It seems apparent that the effects of early school-based experiences should be studied, both for practical, cost-effective reasons and for potential effects on the attitudes of prospective teachers. Also, although specific programs may differ, it should be possible to assess the effects of various types of experiences. Do some experiences have more impact than others? Does an early introduction have a different effect from a late one? Does a gradual approach have a different effect from one compressed into a few weeks? The present study attempted to answer some of these questions as related to training secondary mathematics teachers. Specifically, the effects measured were the attitudes and perceptions about teaching, since it was felt that a teacher's attitudes pervade in determining his or her approach to teaching and eventual effectiveness. A beginning teacher with positive

attitudes can improve teaching skills through experience, but a teacher with poor attitudes is likely to be less effective, even if he or she has developed competency in the skills associated with good teaching.

METHOD

The subjects were 172 junior and senior secondary mathematics teaching majors. Each subject completed two 2 credit methods courses; Principles of Teaching and Methods of Teaching Secondary Mathematics. In the first year of the study, these courses were taken concurrently by seniors during the eight weeks preceding student teaching. In that same year, a group of juniors completed the Principles of Teaching course over a full semester. In the second year, the Methods course was offered as usual and the Principles course was offered only as a semester-long course. The content of the courses remained the same over the entire period, except for practicum experiences.

The table below summarizes the experimental groups and their experiences.

Insert Table 1

The practicum experiences varied from semester to semester, making it possible to compare groups with different experiences. The following brief summaries describe the experiences given in the last column of Table 1.

Peer Teaching: Each student planned and taught four 5 to 10 minute lessons to a group of four or five classmates. Each lesson practiced one of the basic skills: Determining readiness, clarifying objectives, Motivating, and Obtaining feedback. Each lesson was informally critiqued by the classmates.

Micro-teaching: Each student planned and taught two five minute lessons to practice the teaching skills of motivating and questioning. The "students" were four or five sophomores who role-played as secondary students. The lessons were video-taped and a playback was critiqued by a trained supervisor.

Jr. High Aide: Each student acted as an assistant one hour a week for 10 weeks in an individualized 7th-8th grade math class. The usual experience was to help individual or small groups of

students who were working on self-study units.

High School Observation: Each student observed a high school math class one hour a week for 10 weeks. Five different teachers and a variety of math classes were observed.

Teaching College Freshmen: Each student, as a member of a 4-student team, planned and taught a 50-minute lesson in math for elementary teachers. The students observed lessons taught by other team members and participated in an instructor-led critique.

DESIGN AND DATA SOURCE

At the end of each course, the Mathematics Teaching Inventory: Teacher Perceptions (MTI) was administered to assess opinions and attitudes toward mathematics teaching. The MTI was developed by Erb (1972), and contains 56 items about specific teaching practices. Each item has four responses: strongly agree, basically agree, basically disagree, and strongly disagree. The items were classified by the experimenter as favoring a "modern" or a "traditional" approach to teaching and mathematics content. Modern items were coded 4, 3, 2, 1 for strongly agree to strongly disagree, and traditional items were coded 1, 2, 3, 4. Hence, the higher the

score, the more "modern" the attitudes. Modern approaches were those that suggested student-centered, discovery, non-authoritarian methods whereas traditional items suggested memorization, lecture, teacher-centered methods. Furthermore, each item was classified on two dimensions: mathematics vs general teaching perceptions and teacher vs non-teacher focus of questions. This classification produced four subtests.

		FOCUS	
		Teacher	Non-teachers
Teaching Perceptions	Math	MT n = 7	M n = 24
	General	GT n = 10	G n = 15

Further, three pairs of the subtests were combined to produce measures of Math Teaching (MT + M), General Teaching (GT + G) and Teacher's Role (MT + GT).

An example question from each subtest, both modern and traditional is given below.

	Modern	Traditional
G (General Methods)	If a student disagrees with what a teacher says, he should say so.	Students should often be given reading assignments in their textbooks.
M (Math Methods)	Many important mathematical ideas may be taught through the use of games and puzzles.	It is important that students memorize textbook definitions of mathematical terms.
GT (General teacher behavior)	A teacher should be willing to admit mistakes to students.	A teacher should usually introduce new topics by the lecture method.
MT (Math teacher behavior)	A teacher should frequently use real world problems to introduce fundamental mathematical ideas.	The teacher should give students step-by-step procedures for solving mathematical problems.

RESULTS

Table 2 presents the means on each subtest and the total test, for each treatment group. The group labels are the same ones used in Table 1. Groups 1S and 2S and groups 3S and 4S were combined, since their methods and practicum experience were the same.

Insert Table 2 about here

Two separate one-way ANOVAs were performed; one to investigate the effects of different early practicum experiences in the Junior year, and a second to investiage the effects of separate versus concurrent methods courses. The dependent variables in each ANOVA were the scores on each subtest of the MTI. Three further scores were obtained by combining pairs of subtests:

Teaching Math: Subtests MT + M

Teaching Behavior: Subtest MT + GT

Teaching Methods: Subtests GT + G

Summaries of the ANOVAs are presented in Tables 3 and 4.

Insert Tables 3 and 4 about here

CONCLUSIONS

The study has some limitations which should be considered when interpreting the results. The experimental treatments were not well controlled due to the long time period over which the study took place. The program was continually changing and

some students had different experiences than others in the same group. The basic content of the courses remained fixed but the learning activities changed from semester to semester. In the practicum experiences, different teachers were observed and different students were taught at different times of day and in varying circumstances. These and other uncontrolled factors inherent in a study of this type may have had effects on the results.

The results related to different practicum experiences allow several conclusions. In general, the means on the subtests indicated that the group with only observation experience held more modern and open attitudes toward teaching than the other two groups. This result was most significant for the subtest related specifically to mathematics teacher behavior. The dampening effect of teaching experience mentioned earlier may have affected the attitudes of the group that acted as teacher aides. On the other hand, it is useful to note that the group with no school-based experience was very similar in its attitutdes. It may be, as these results indicate, that an early non-threatening experience such as observation is preferable to either of these extremes.

The analyses of differences between methods groups indicated

that across all subtests, the separate methods group held the most open, teacher-centered attitudes. Recall that this group had already taken the Junior general methods course. The significant differences were found on the subtest of mathematics teaching methods. The separate methods group had a combination of factors making it different from the concurrent group, and it is most likely the combination rather than any one factor which accounts for the higher scores. Teaching a college freshman class was a more realistic experience than micro-teaching and may have contributed to more positive attitudes. The chance to reflect on previous experiences in the Junior course may have enabled further growth in the separate methods group.

A final point is worth making in relation to the MTI and its ability to reflect attitudes about teaching. In the Principles course, the MTI Subtest MT (Math Teacher Behavior) discriminated between groups. The Principles course is primarily concerned with mathematics teaching skills (questioning, motivation, teaching of concepts, teaching of problem solving) and the focus is on the behavior of the teacher. In the Methods course, the focus shifts to special methods and strategies (discovery, individualization, lab approach) and to students (low-achievers, discipline, learning theory).

For this course, the MTI Subtest M (Math Methods) discriminated between groups.

To summarize, these results support the notion that methods courses have effects specific to subject matter and suggest that courses should be spread out rather than concentrated in one semester. Early school-based practicum experiences are preferable to no experience, but caution should be exercised in selecting experiences which may have dampening effects on attitudes. On the other hand, attitudes appear to improve when students have a second separate course. This may indicate that contact with schools should take place before the completion of methods instruction.

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TABLE 1

Description of Treatment Groups

Group[a]	Semester	Methods[b] Course	Practicum Experience
1J	Fall 1972	Principles (sem)	Peer Teaching
1S	Fall 1972	Concurrent Principles (8 wk) and Methods (8 wk)	Micro-teaching
2J	Spring 1973	Principles (Sem)	Peer Teaching Jr. High Aide
2S	Spring 1973	Concurrent Principles (8 wk) and Methods (8 wk)	Micro-teaching
3J	Spring 1974	Principles (sem)	Peer Teaching High School Observation
3S	Fall 1973	Methods (8 wk)	Teach College Freshmen
4S	Spring 1974	Methods (8 wk)	Teach College Freshmen

[a] J: Junior year, S: Senior year

[b] sem: semester course, 2 hours a week
8 wk: 8 week course, 4 hours a week

TABLE 2

Means and Standard Derivations of Treatment Groups on MTI Subtests.

		Subtest							
Group	N	G		M		GT		MT	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1J	16	44.6	3.2	65.9	4.6	29.8	2.9	20.0	2.0
2J	17	45.4	2.9	6[illegible].6	4.7	30.4	1.9	21.4	2.2
3J	24	46.6	2.5	63.5	4.7	30.7	2.4	21.9	2.2
1,2,3J	57	45.7	2.9	66.5	4.8	30.4	2.4	21.2	2.2
1,2S	62	46.1	3.7	69.4	4.5	31.2	2.8	21.5	2.4
3,4S	54	45.3	3.1	67.7	4.8	30.9	2.6	21.5	2.2

TABLE 3

Summary of ANOVAs of MTI Subtest Scores for Junior Groups (1J, 2J, 3J)

Subtest	F	p[a]	Comparison[b]
G (General Methods)	2.7	.079	—
M (Math Methods)	2.4	.097	—
GT (General Teacher Behavior)	0.8	.466	—
MT (Math Teacher Behavior)	3.8	.029	1J < 3J
Teaching Math	3.3	.044	—
Teaching Behavior	2.7	.077	—
General Teaching	2.6	.080	—

[a] df = 2,56

[b] Groups which differ significantly ($p < .05$) on a Scheffe Multiple Range Test.

TABLE 4

Summary of ANOVAs of MTI Subtest Scores

for Methods Groups

(Juniors, Separate, Concurrent)

Subtest	F	p[a]	Comparison[b]
G (General Methods)	0.7	.499	____
M (Math Methods)	4.2	.017	Jr. < Separate
GT (General Teacher Behavior)	1.6	.214	____
MT (Math Teacher Behavior)	0.3	.762	____
Teaching Math	3.1	.049	____
Teacher Behavior	1.1	.320	____
General Teaching	1.1	.328	____

[a] df = 2,171

[b] Groups which differ significantly ($p < .05$) on a Scheffe Multiple range Test.